LAWRENCE
LIVERMORE
NATIONAL
LABORATORY

LLNL prototyping strategy and plans

Ghaleb M. Abdulla and Marcus Miller

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Video conference presentation to NCSA and NOAO

LSST prototyping strategy and plans

Ghaleb Abdulla and Marcus Miller

R&D outline

- Modular data-centric pipeline
- Support for real-time query processing
- H/W and S/W cluster architecture
- Other issues:
  - LSST Digital Library
  - Database design and continuous query processing
  - Confidence level and object relevance

LLNL prototyping strategy and plans

- Use SM data pipeline to test:
  - Scalability on parallel cluster architectures
  - Support of real time analysis
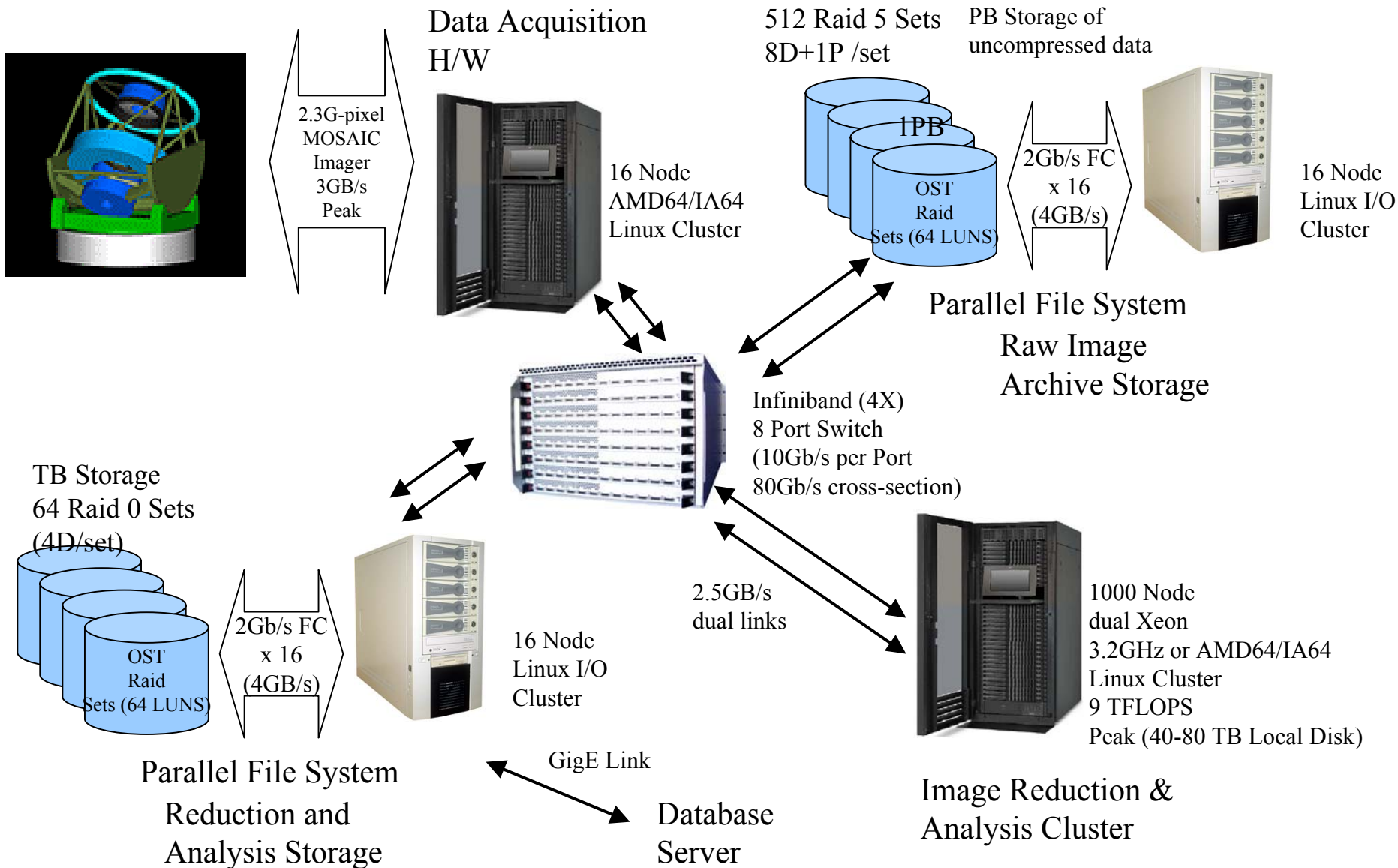 - Generate synthetic data to test with anticipated LSST data rates

Modular data-centric pipeline

- Support different data pipelines based on data objects
    - Objects have associated metadata
    - Algorithms read object's metadata and process it accordingly
- Reduce complexity of the system by using a modular workflow design
- Algorithms are designed independent of the data pipeline
- New data pipelines are constructed easily using libraries of algorithms and self describing objects
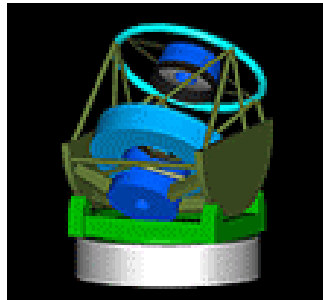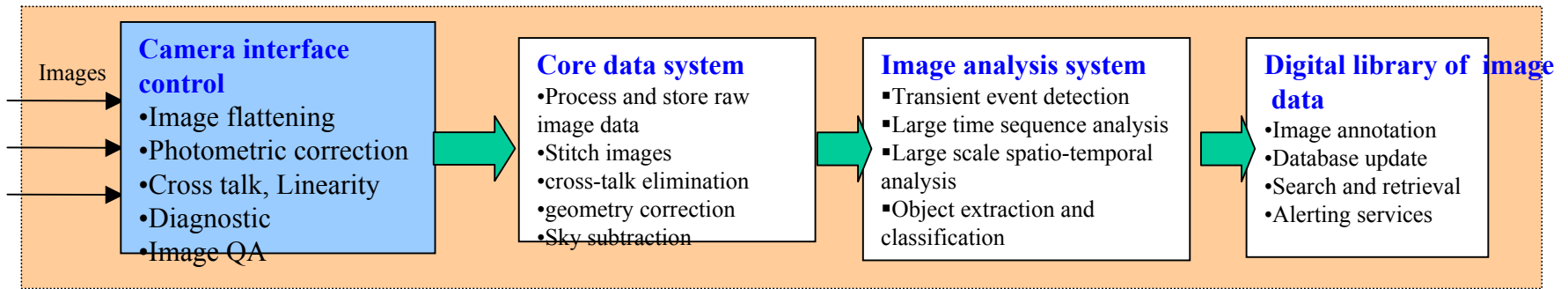
Support for real-time query processing

- Characterize user queries and real-time requirements
- Design a streaming query processor for the real time data (continuous queries)
  - Query language
  - Windowing algorithms
  - Query optimization
    - Dynamic indexing, cost models
  - Dynamic continuous queries (DCQ)

H/W and S/W Architecture

Data Acquisition
H/W

2.3G-pixel
MOSAIC
Imager
3GB/s
Peak

16 Node
AMD64/IA64
Linux Cluster

512 Raid 5 Sets
8D+1P /set

PB Storage of
uncompressed data

1PB

OST
Raid
Sets (64 LUNS)

2Gb/s FC
x 16
(4GB/s)

16 Node
Linux I/O
Cluster

Parallel File System
Raw Image
Archive Storage

Infiniband (4X)
8 Port Switch
(10Gb/s per Port
80Gb/s cross-section)

TB Storage
64 Raid 0 Sets
(4D/set)

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16 Node
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Cluster

2.5GB/s
dual links

1000 Node
dual Xeon
3.2GHz or AMD64/IA64
Linux Cluster
9 TFLOPS
Peak (40-80 TB Local Disk)

Parallel File System
Reduction and
Analysis Storage

GigE Link

Database
Server

Image Reduction &
Analysis Cluster

Camera Interface Control

Camera interface control
- Image flattening
- Photometric correction
- Cross talk, Linearity
- Diagnostic
- Image QA

Images

Core data system
- Process and store raw image data
- Stitch images
- cross-talk elimination
- geometry correction
- Sky subtraction

Image analysis system
- Transient event detection
- Large time sequence analysis
- Large scale spatio-temporal analysis
- Object extraction and classification

Digital library of image data
- Image annotation
- Database update
- Search and retrieval
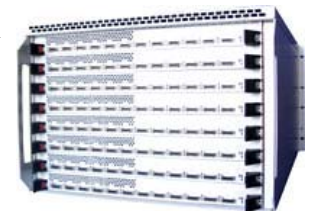- Alerting services

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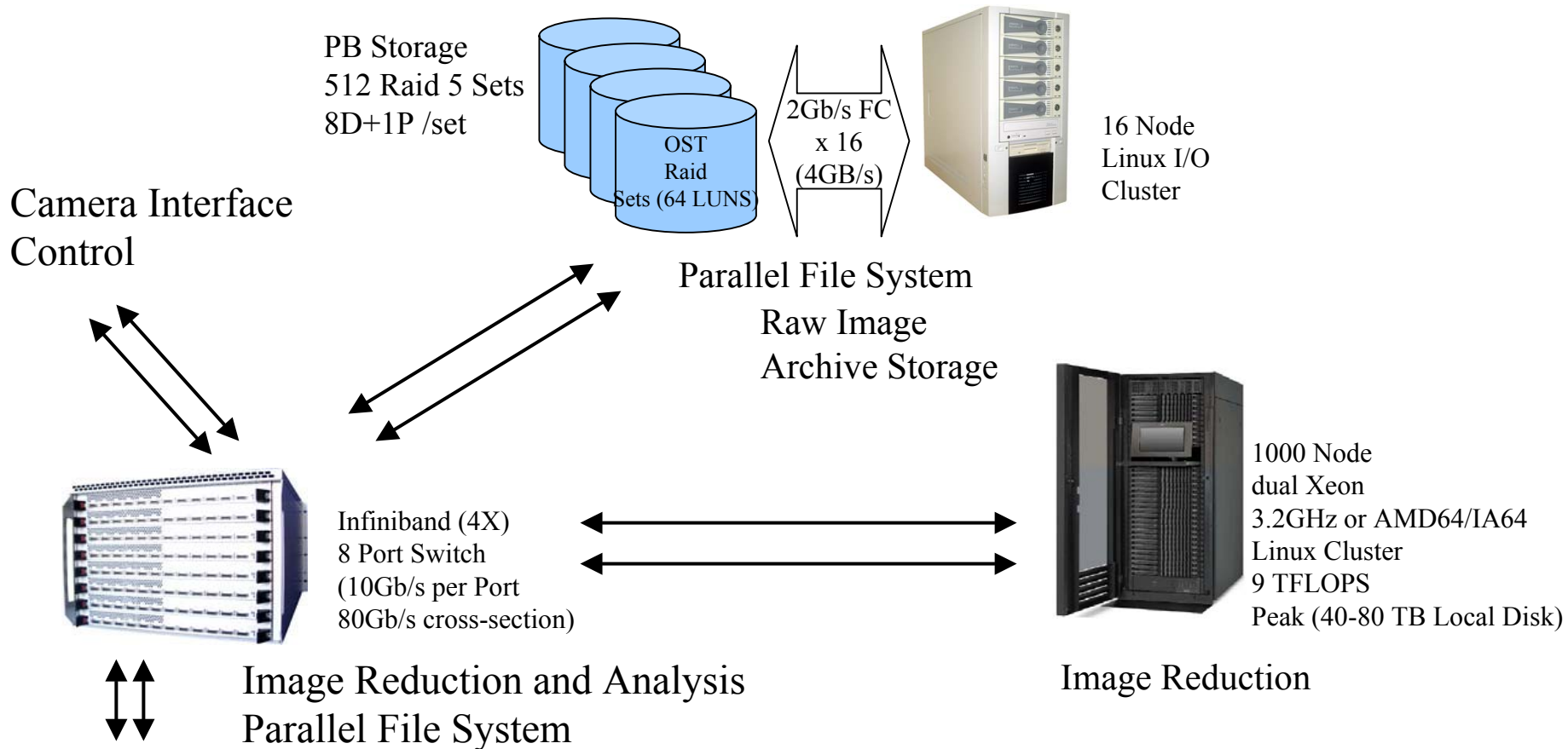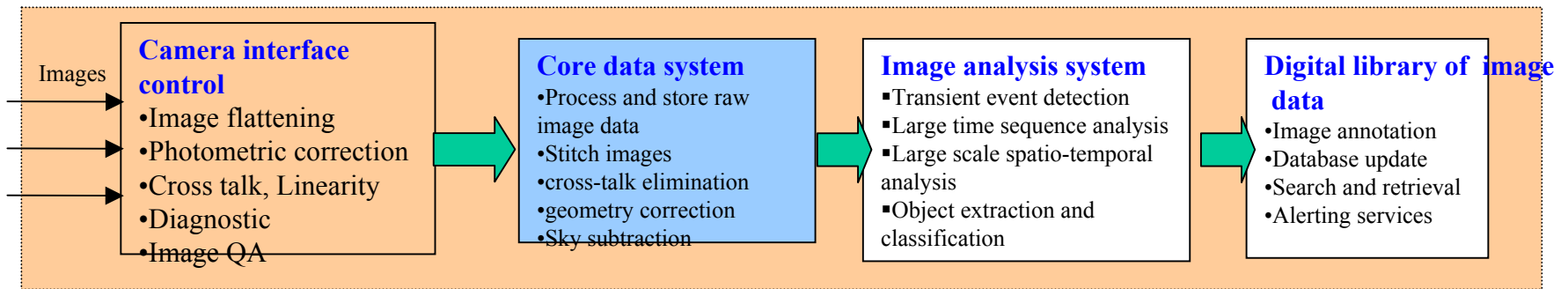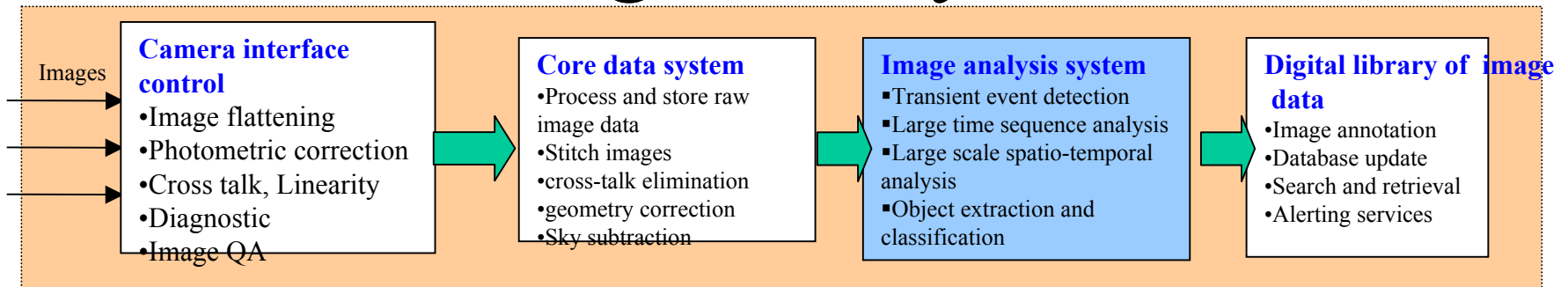
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Core Data System

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Image Reduction and Analysis Parallel File System

Image Reduction

Image Analysis

Images

Camera interface control
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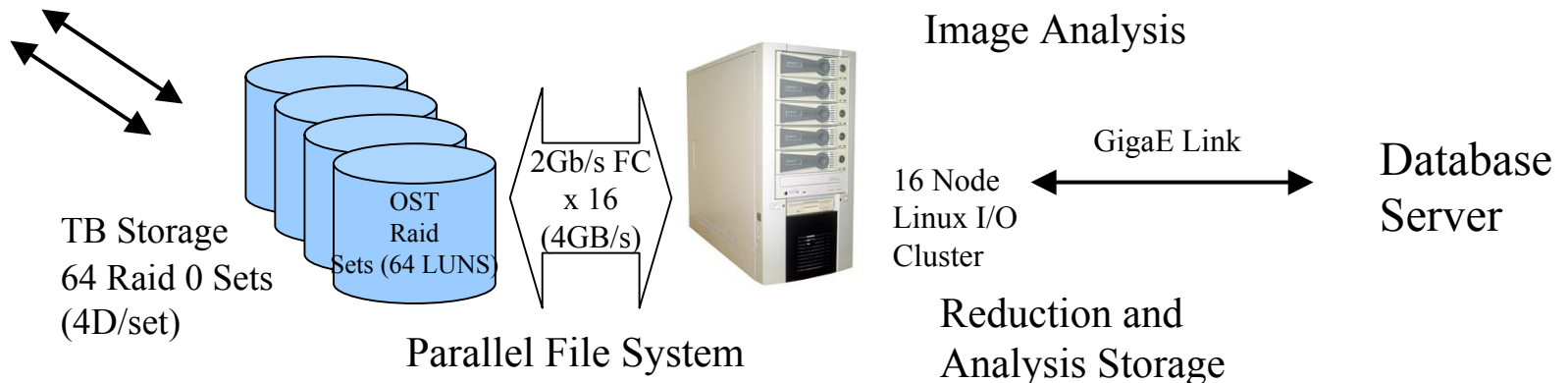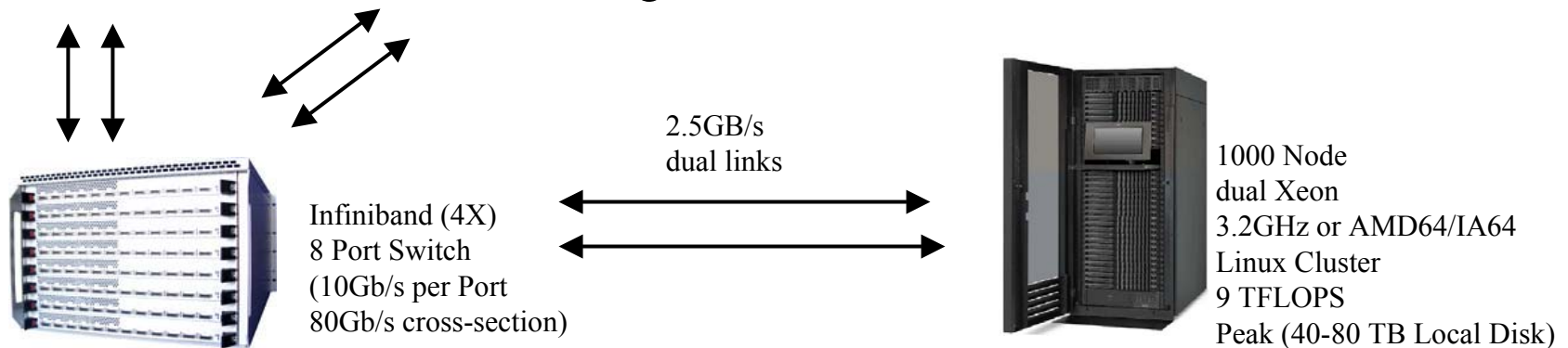Linux I/O
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Reduction and
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Parallel File System

Other R&D issues

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  - Real-time requirements (30 sec)
- Database design and continuous query processing
- Confidence level and relevance

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